Climate Change and Vector Problems

Mosquitoes, Ticks

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Climate Change Effects
Length of Mosquito Control Season

- Hotter, longer, possibly wetter mosquito-breeding seasons.
- Current mosquito control season in Delaware
  - Starts in mid-March, typically ends by mid-November (8 months)
  - Core period from early May to mid-October (5-1/2 months)
- If Delaware climate might become more like SC, GA, or north FL?
  - Starts in mid-February, probably ending by mid-December (10 months)
  - Core period from early April to mid-November (7-1/2 months)
- Overall, about a 2-month longer (25% longer) control season.

Climate Change Effects
Biological Impacts

- Larger, more abundant mosquito populations
  - Higher larval dipper counts
  - Higher adult light trap counts
  - Higher landing/biting rate counts
  - More public complaints, requests for mosquito relief

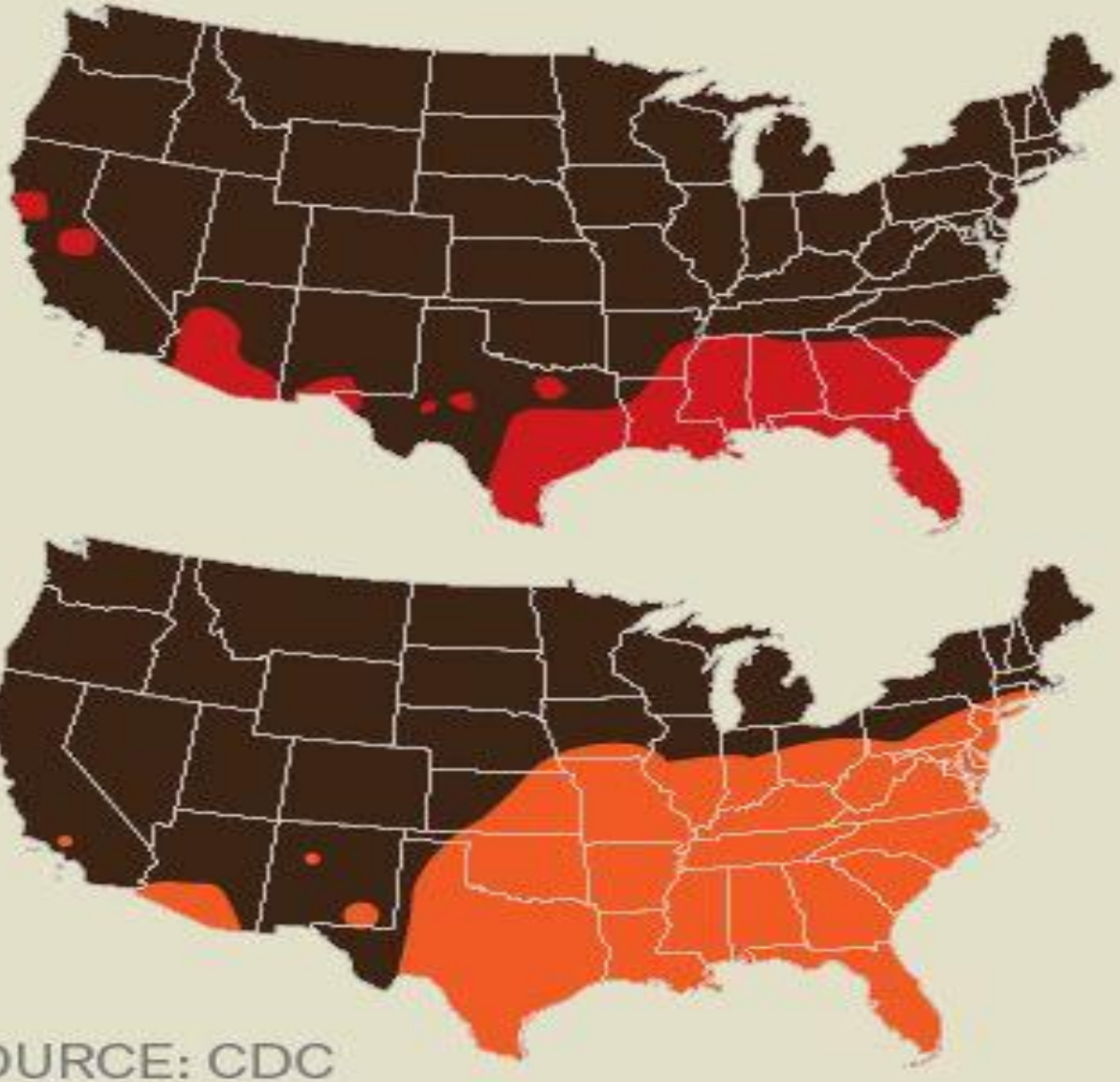
- Pathogen/disease impacts
  - Primary concerns in Delaware -- West Nile virus (WNV), eastern equine encephalitis (EEE)
  - Secondary concerns in Delaware – dengue fever, chikungunya, Zika (re: ATM vector)
  - Other areas of country or world – malaria, yellow fever (*note*: recent YF outbreak in Brazil after long drought period followed by heavy rains, might be climate change related)
  - ❖ Higher pathogen amplification levels within mosquito (higher viremia)
  - ❖ Faster pathogen replication cycles/rates within mosquito (3 days instead of 4-5 days?)
  - ❖ More pathogen-infected mosquitoes (absolute numbers, percentages) with higher viremia levels, more disease transmissions

- Mosquito production/disease transmissions occurring at higher altitudes
  - Not a big factor in flatland Delaware
  - But can be elsewhere – e.g. increased malaria at higher elevations in east Africa

Climate Change Effects
Geographic Range Impacts

- Northward expansions of present species ranges.
- Our big concern – more frequent and abundant occurrences of yellow fever mosquitoes (*Aedes aegypti*) in Delaware (at present very rare and infrequent) – major vector for yellow fever, dengue fever, chikungunya, Zika.
- Northward expansion of Asian tiger mosquitoes (*Aedes albopictus*) into NY and New England – already have plenty of ATMs in Delaware! Secondary vector for WNV, potential vector for dengue fever, chikungunya, Zika.

Officials think there could be more outbreaks in the US



Approximate distribution of *Aedes aegypti* mosquitoes

Approximate distribution of *Aedes albopictus* mosquitoes

SOURCE: CDC

Vox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Both species “vector competent” for Zika transmission, however:

- *Aedes aegypti* – superb vector
  - feeds almost exclusively on people
  - will take brief, multiple blood meals from several people
  - common in backyards, readily enters houses to feed or rest
- *Aedes albopictus* – not as good, but of concern
  - besides people also feeds on other mammals plus birds
  - usually takes longer blood meals from single source
  - also common in backyards, but less likely to enter houses
- Both are peri-domestic container-breeders in urban/suburban areas and other developed locations, fortunately having short flight ranges.

Climate Change Effects
Shifts in Mosquito Production Locations

- Relative sea-level rise causing landward transgression of salt marshes into formerly upland areas.

- Production sites/habitats for saltmarsh mosquitoes (*Aedes sollicitans*) are changing in manner at least temporarily unknown to our inspectors, causing treatment response problems.

- Also negating the control efficacy of our source reduction marsh water management efforts (OMWM systems).

Climate Change Effects
Practicable Operational Impacts

- More needs, demands from public for prevention or treatment services.
- Greater costs for mosquito control (perhaps 25-50% increase), more staff probably needed– Mosquito Control annual budget might have to grow from $2 million/year to perhaps $2.5-$3.0 million/year.
- More insecticide use to control problems, both larvicides and adulticides – not desirable outcome environmentally.

Climate Change Effects Tick-caused Problems

- Similar as with mosquitoes, warmer climate = range expansions, more ticks, more tick bites, more tick-borne disease transmissions . Everything becomes more intense and of longer duration within the year. Also greater white-footed mouse populations, primary host reservoir for Lyme disease.

- Primary tick concerns in Delaware:
  - Deer or Black-legged tick (*Ixodes scapularis*) – Lyme disease, anaplasmosis, babesiosis, ehrlichiosis, Powassan, bartonella
  - American Dog or Wood tick (*Dermacentor variabilis*) – Rocky Mountain spotted fever, tularemia, tick paralysis
  - Lone Star tick (*Amblyomma americanum*) – ehrlichiosis, tularemia, STARI, Alpha-gal red meat allergy

- Perhaps better exemplified with a wildlife example, involving the effects of winter ticks (*Dermacentor albipictus*) on moose populations -- warmer temperatures, shorter winters, better tick survival, larger tick populations, longer duration of tick contacts, more stricken or dead moose.